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PHOTOELECTRIC BVI_c OBSERVATIONS, NEW ELEMENTS AND A NEW CLASSIFICATION FOR BZ Tuc

BZ Tuc = HV 821 was included in our program of photoelectric observations for Cepheids because it is listed in GCVS-IV as a classical Cepheid with the elements

$$MaxJD = 2444141.64 + 127.61 \times E.$$

We observed the star at CTIO during September-November 1996 using the 1.0–m reflector. A total of 26 BVI_c measurements were obtained (Table 1), the accuracy of the individual data being near $\pm 0\overset{m}{.}01$ in all filters. Our new observations are plotted as filled dots in Figure 1, while open circles refer to our earlier observations (Berdnikov & Turner, 1995).

The slight offset of the new observations from our earlier observations in Figure 1 suggests that our data do not satisfy the above elements. In order to refine them, we analyzed all available published observations using Hertzsprung's method; the derived epochs of maxima, listed in Table 2, together with times of maxima from Leavitt (1908), were introduced into a linear least squares solution to obtain the following improved ephemeris:

$$MaxJD = 2430242.8 + 127.447 \times E.$$

Table 1

JD 2450300+	V	$B-V$	$V-I_c$	JD 2450300+	V	$B-V$	$V-I_c$
51.6601	11.794	0.793	0.874	81.6460	11.680	0.932	0.954
52.7280	11.763	0.800	0.867	82.6389	11.661	0.940	0.952
53.6278	11.756	0.808	0.867	83.6399	11.650	0.943	0.966
54.6378	11.748	0.807	0.871	84.6350	11.709	0.969	0.985
55.6658	11.784	0.799	0.872	86.6257	11.691	0.981	0.969
57.6306	11.735	0.804	0.866	87.6555	11.712	0.998	0.976
58.6354	11.738	0.811	0.867	88.6383	11.719	1.009	1.005
59.6230	11.719	0.824	0.869	89.6342	11.743	1.023	1.020
61.6585	11.700	0.823	0.865	90.6310	11.750	1.051	1.014
62.6531	11.704	0.836	0.875	91.6228	11.771	1.055	1.036
63.6294	11.706	0.820	0.889	92.6297	11.779	1.072	1.036
79.6424	11.652	0.893	0.955	93.6331	11.800	1.073	1.046
80.6372	11.669	0.948	0.954	94.6770	11.810	1.097	1.051

Table 2

$MaxJD$ 2400000+	Uncertainty	Filter	E	$O-C$	Number of Observations	Author
10097.00	–	pg	−158	−9.17	–	Leavitt, 1908
34443.23	±1.15	B	33	−5.32	10	Gascoigne, Kron, 1965
34449.94	±1.91	V	33	1.39	12	Gascoigne, Kron, 1965
41070.64	±0.33	B	85	−5.15	18	Eggen, 1977
41203.26	±0.64	V	86	0.02	25	van Genderen, 1983
41203.86	±0.48	V	86	0.63	18	Eggen, 1977
41325.48	±0.32	B	87	−5.21	23	van Genderen, 1983
41834.12	±0.40	B	91	−6.35	10	Madore, 1975
41839.31	±1.11	V	91	−1.17	10	Madore, 1975
44011.44	±1.17	V	108	4.37	9	Freedman at el., 1985
44135.92	±0.85	V	109	1.40	6	Harris, 1980
44515.26	±0.29	B	112	−1.60	34	Caldwell, Coulson, 1984
44521.02	±0.34	V	112	4.16	37	Caldwell, Coulson, 1984
50117.60	±0.31	V	156	−6.92	32	This paper
50238.23	±0.24	B	157	−13.74	30	This paper

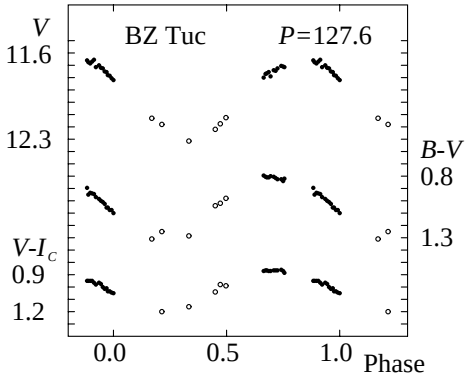

Figure 1. The light curve of BZ Tuc established by our earlier observations (Berdnikov & Turner 1995), open circles, and the observations of Table 1, filled circles

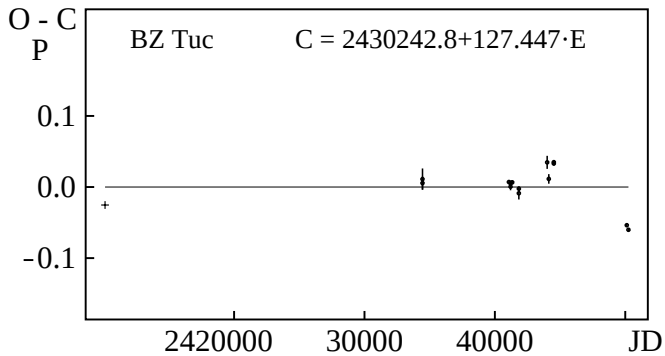

Figure 2. The O−C diagram for BZ Tuc. For convenience the O−C values are expressed in fractions of the period

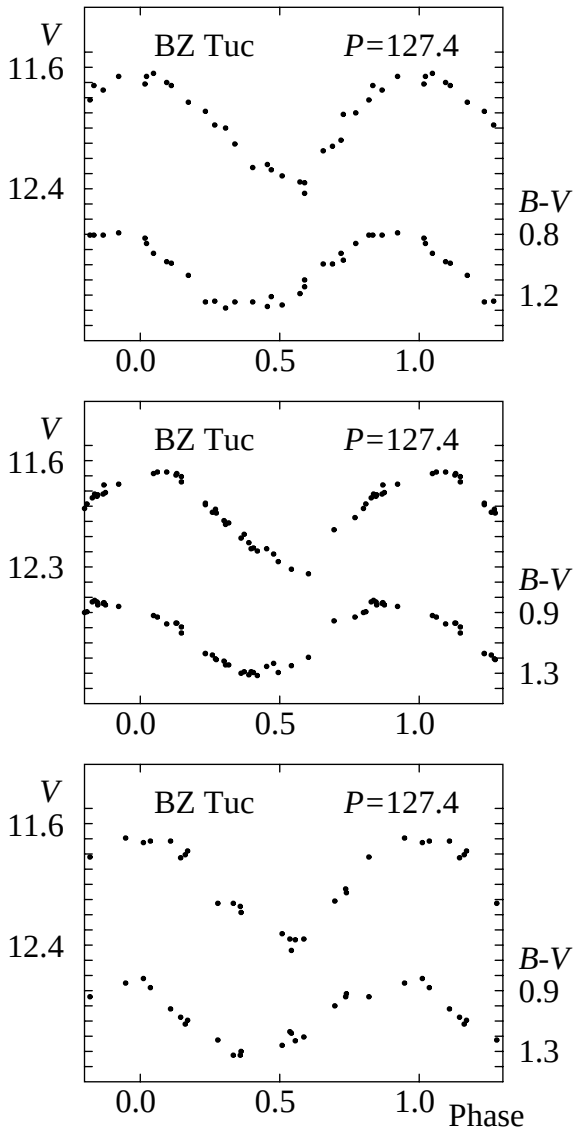

Figure 3. The light curve of BZ Tuc according to van Genderen (1983), top, Caldwell & Coulson (1984), middle, and Eggen (1977), bottom

The new ephemeris was used to calculate the $O-C$ values listed in Table 2, as well as for plotting Figures 2 and 3. In both Table 2 and Figure 2 we have taken into account that maxima in filter B precede those in V by 6.0 days. The data of Figure 1, as well as the observations of van Genderen (1983), Caldwell & Coulson (1984), and Eggen (1977), which are replotted in Figure 3a–c for the new ephemeris, indicate that the shape of the light curve of BZ Tuc varies slightly. Moreover, a shift in the times of maxima for $B-V$ relative to those in V is evident. Such variability in light curve shape suggests that BZ Tuc cannot be a classical Cepheid. Likewise, it cannot be a type II Cepheid because of its very long period. Possibly BZ Tuc is an RV Tauri variable or alternatively a semiregular variable of the UU Herculis class.

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